

[illegible]

The present invention has to do with a support structure for isolating earthquake motions, and more particularly, to prevent a chain vibrations of a structure from earthquake and/or wild storm such as hurrican.

Heretofore, conventional earthquake-proof constructions are based on methods to alleviate gearing of earthquake motions by intermediately connecting elastic materials such as springs, rubber, lead and balancer etc. between a foundation and a bottom of structures.

Present invention is to provide another unique method to isolate linkage vibration of the earthquake and wild storm to above structures taking advantage of frictionless nature in

small balls.

#### SUMMARY OF THE INVENTION;

The present invention is designed to put a constructions on a collective block of frictionless large and small steel balls.

Explaining my invention in more detail, the device is designed to interpose steel balls between pressure-receiving and pressure-applying spherical curved surfaces facing each other as shown in annexed drawings, hence transmission of earthquake motions are isolated by frictionless rolling of above said two types of balls interposed between the two curved spherical surfaces facing each other as soon as earthquake occurs. This is the case, just like the case of a ship on the water, in which we have no earthquake feeling since trembles are isolated by allowing the waving water to receive and transforming them into rolling forces of the water wave.

A preferred form of the invention is illustrated in the accompanying drawings in which;

Fig. 1 is a plan view of the invention showing a foundation hoop trembled from the east to the north direction.

Fig. 2 is a sectional view of a composition of the foundation hoop, a colum, a structure foundation and a frictionless slide of the invention.

Fig. 3 is imaginary view of a linkage movement of the foundation hoop when an earthquake occurs.

Fig. 4 is perspective view of a aligning frame for sliding balls when earthquake motions were isolated.

Fig. 5 is is a perspective view of the hoop of the invention.

Fig. 6 is a perspective view of the hoop aligning frame.

Fig. 7 is a view fixing hole for ballsortion which

Fig. 7-1 is a perspective view of portions which closed for large balls and opened for small balls.

Fig. 8 is a sectional view of press working of a concave curved surface and a convex curved surface.

Fig. 9 is a partial perspective view of a ball holes.

Fig. 10 is a partial perspective view of a frictionless sliding concave portion.

Fig. 11 is a set view of concaved and convexed steel plates piled on spherical curved steel and iron blocks.

Referential numerals in the drawings;

1--foundation hoop.

2--connecting bolts of concave curved surface  
convex curved surface.

3--pressure-receiving large balls (10. 318mm.).

4--rolling unyfining small balls in point contact  
with large large balls (4).

5--concave formed steel plate of pressure-  
receiving surface.

6--convex formed steel plate of pressure-  
applying surface.

7--ball aligning frame.

8--sodium silicate.

9--foundation of column.

10-liquid replenishing pipe.

11-liquid sealing packing.

12-polybiny1 chloride ball cover.

13-concrete covering all the surface of top  
and bottom steel plates.

14-connecting steel frame for hoop tightning.

15--steel and iron concrete frame.

16--spherical surface iron and steel reinforced  
concrete of concaved slide block.

17--bolts for pressing spherical surface.

18--pressing bolts and nuts.

19--provisional tightning portion for spherical  
surface.

20--provisional concrete frame.

21--pressing slots.

22--iron frame for spherical surface.

23--foundation hoop (same as the numeral 1)

24--foop tightning frame.

25--ball sliding block.

26--fixing tool for ball holes.

27--fixing tool for large and small balls.

## DETAILED DESCRIPTION OF THE INVENTION;

According to my invention, steel balls (3) and (4) are interposed between pressure-receiving spherical curved steel plate (5) and pressure-applying spherical curved steel plate (6) as shown in the drawing 1. The peripheral scales of these plates are adjusted with that of a bottom of a structure such as a house or building to be built.

These plates are made of steel and used as a ball receiver. The shape of the pressure-receiving plate is recessed concave formed one and another pressure-applying plate is convex formed one.

These two opposing spherical plates are used as foundation of the building and also for the purpose of isolating earthquake motions as above described.

Pressure-receiving steel balls and balls with (less accuracy) smaller diameter than that of pressure-receiving balls are mounted to come in point contact in all directions.

The pressure-receiving concave curved surface (5) is supported by the pressure-receiving steel balls (3) and as soon as the earthquake occurs, the linkage of earthquake motion to the building is isolated by the rolling slide of pressure-receiving steel balls (3).

As to the structure of the foundation, a concrete covering all the surfaces of top and bottom steel plate interposed by the balls except the curved surfaces of the top and bottom plates constitutes a column (9) and the same applies to the foundations. The column (9) including the pressure-applying convex-curved surface is jointed to the foundation including pressure-receiving concave-curved surface by strain adjusting bolts and nuts.

When the pressure receiving balls (4) are rolled by the earthquake motions small balls (3) interposed throughout the whole periphery of said balls (4) are rolled simultaneously, in which, as



before described, the linkage of earthquake motion to the structure or building is isolated by the rolling slide of the pressure-receiving steel balls.

To cope with jump-up phenomenon caused by directly under earthquake or float-up phenomenon caused by typhoon etc., the hoop (1) is put on the foundation.

The hoop (1), without striving against linkage of earthquake motion, supports column (9) together with the foundation.

Because the steel balls (4) moves to the side of higher foundation pressure-receiving curved surface when the building moves due to hurricanes, building mounted on the foundation hoop (1) leans towards the wind pressure direction and increases resistance.

In addition, in order to completely achieve functions of this device, materials with properties of (sodium silicate, etc.) are filled

with their properties of rust prevention, anti-freezing, and lubrication maintained are filled and functions of isolating earthquake are held semi-permanently.

The pressure applying and receiving steel plates are HRC50 and are free of dent when tested for withstanding pressure at 1 ton using pressure receiving steel balls.

Concrete with strength of KGJ cm/700 are used. When this invention apply to the column with cross section of 80cm 80cm, the pressuer-receiving force of 3200 ton is obtained.

#### STRUCTURING PROCESS OF THE INVENTION;

1. Viscous materials with properties of rust prevention is spread and coated onto the plane steel plate on spherical curved iron and steel frame adjusted so as to fit to a projected structure.
2. Fit the hole cast (Fig. 9) in a projecting pole of position frame (Fig. 7).
3. Insert all small balls (4) into above said holes

after closing the holes for balls (3).

4, Pulling up the holes cast horizontally (Fig. 9),

then, fit a regular hole onto projection pole.

5, All large balls (3) are casted in free movement.

6, Suffice the NA2S103 to concrete mortar partition plate by supply pipe, then, steel plate and block composed iron and steel frame are piled on them.

7, Concaved and convexed slide blocks are put on press ditch (Fig. 8) and press it by short-term clamp bolt-nut by which concaved and convexed spherical surface are made.

8, Construct a provisional concrete frame, then put concrete into above structured frame.

9, When applying weight reached to a exceeding level of steel plate repulsion, provisional frame is solved.

10, Fundamental hoop is connected to combined hoop tightning frame by scale of  $1/4$  (Fig. 6). By this processing the hoop aligns with earthquake

motion and wind pressure successfully.

2022-09-08